



Government Employees' Retirement System of the Virgin Islands

**Actuarial Valuation and Review as of
October 1, 2018**

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September 3, 2019

Board of Trustees
Government Employees' Retirement System of the Virgin Islands
GERS Complex
St. Thomas, Virgin Islands, 00802

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of October 1, 2018. It summarizes the actuarial data used in the valuation, analyzes the preceding year's experience, and establishes the funding requirements for fiscal year ending September 30, 2019 and later years.

This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the Board to assist in administering the Retirement System. The census information and financial information on which our calculations were based was prepared by the GERS staff under the supervision of Mr. Austin L. Nibbs CPA, CGMA. That assistance is gratefully acknowledged.

The actuarial calculations were directed under the supervision of Leon F. (Rocky) Joyner and Aldwin Frias. We are members of the American Academy of Actuaries and we meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of our knowledge, the information supplied in this actuarial valuation is complete and accurate. Further, in our opinion, the assumptions as approved by the Board are reasonably related to the experience of and the expectations for the Retirement System.

We look forward to reviewing this report at your next meeting and to answering any questions.

Sincerely,

Segal Consulting, a Member of The Segal Group, Inc.

By:

A handwritten signature in black ink, appearing to read "L. Joyner", written over a horizontal line.

Leon F. (Rocky) Joyner, ASA, FCA, MAAA, EA
Senior Vice President and Actuary

A handwritten signature in black ink, appearing to read "A. Frias", written over a horizontal line.

Aldwin Frias, FSA, FCA, MAAA, EA
Senior Vice President and Actuary

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Section 1: Actuarial Valuation Summary

Purpose and Basis

This report was prepared by Segal Consulting to present a valuation of the System as of October 1, 2018. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits and to provide information for required disclosures under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of Plan assets to cover the estimated cost of settling the Plan's benefit obligations. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

Certain disclosure information required by GASB Statements No 67 and 68 as of October 1, 2018 for the System is provided in a separate report.

The contribution requirements presented in this report are based on:

- The benefit provisions of the Retirement System, as administered by the Board as of October 1, 2018;
- The characteristics of covered active members, inactive vested members, and retired members and beneficiaries as of September 30, 2018, provided by the GERS;
- The assets of the Plan as of September 30, 2018, provided by the Fund Auditor;
- Economic assumptions regarding future salary increases and investment earnings;
- Other actuarial assumptions regarding employee terminations, retirement, death, etc. and
- The funding policy adopted by the System.

Significant Issues

The following key findings were the result of this actuarial valuation:

1. Based on the results of this valuation, the System is projected to run out of assets in the fiscal year beginning October 1, 2023. However, depending on the liquidity of the System's assets, the System's inability to pay full benefits could be sooner. For illustration purposes, if we assume 0% return on assets, the System is projected to be insolvent during the fiscal year beginning October 1, 2022 (*i.e.*, one year earlier). Upon insolvency, the projected contributions (net of expenses) are expected to cover only about 40% of the projected benefits. Without additional financial resources (contributions or other commitments) and/or adjustments to the benefit levels, the System's continued viability is in jeopardy.
2. It is our understanding that the legislation that covers the System provides that contributions are to be made on an actuarial reserve basis. An actuarial valuation is performed to calculate the "Actuarially Determined Employer Contributions" (ADEC) and is based on the assumptions and methods adopted by the Board for this purpose.
3. Segal Consulting ("Segal") strongly recommends an ADEC that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and the principal balance. The funding policy adopted by the Board meets this standard. However, the actual amounts contributed by the government employers to the System have not been based on the ADEC amounts. The amounts contributed have been significantly less than the ADEC (*see Section 2: History of Employer Contributions*) for many years:
 - a. While the employer contribution rate is currently at 20.5% of pay, the ADEC has increased from 35% of pay in 2007 to 69% of pay as of October 1, 2018.
 - b. Therefore, current benefits are not being funded adequately on an actuarial basis. Section 718(l) of the Virgin Islands Code prohibits the Board from paying benefits that are not adequately funded.
4. The historical and continuing shortfall in the contributions to the System has resulted in increasing negative cash flow, declining assets, increasing unfunded actuarial liabilities and as noted above, projected insolvency, if nothing else is done.
5. Since 2006, the System's funding percentage has declined from 56% to 21% based on a long-term investment return assumption (currently, 7.00%). The funding percentage as of October 1, 2018 based on GASB 67/68 accounting standards is 15.6%, which uses a rate of return of 4.25%. As indicated above, this decline is primarily due to contributions being significantly less than the amount necessary for proper plan funding.

6. The 7.00% investment return assumption is based on a long-term funding approach which includes a presumption that action will be taken that prevents insolvency and provides a sustainable future for GERS. If such action is not forthcoming, the 7.00% investment return assumption will be re-evaluated in future valuations and will likely be reduced significantly to reflect the lower expected investment returns under the current low interest rate environment and due to the System's liquidity requirements and dynamic asset allocation strategy.
7. In the event of insolvency, the Board will need to prepare well in advance how to equitably reduce the benefits to the level of contributions that are coming in, including any advance notice to all affected members and stakeholders.
8. Additional projections are provided on a separate report demonstrating potential "no-solution" scenarios showing the practical implications when the System runs out of money and potential "sharing the pain" scenarios showing possible solutions to maintain the System's solvency.
9. The actuarial valuation report as of October 1, 2018 is based on financial and demographic information provided as of that date. Changes in the value of assets subsequent to that date are not reflected. Unfavorable asset experience will increase the actuarial cost of the System, while favorable experience will decrease the actuarial cost of the System.
10. Since the actuarial valuation results are dependent on a given set of assumptions, there is a risk that emerging results may differ significantly as actual experience proves to be different from the assumptions. We have not been engaged to perform a detailed analysis of the potential range of the impact of risk relative to the System's future financial condition, but have provided sensitivity projections periodically on the impact of investment returns and lower employment levels. A more detailed assessment of the risks would provide the Board with a better understanding of the inherent risks. This could be important because:
 - a. the System's assets are quickly diminishing,
 - b. retired participants account for most of the System's liabilities, leaving limited options for reducing costs, and
 - c. actual contributions have been significantly less than the ADEC for many years.

Summary of Key Valuation Results

		2018	2017
Contributions for plan year beginning October 1:	• Actuarially determined employer contributions (ADEC) ¹	\$277,523,563	\$267,743,116
	• ADEC ¹ as a percent of payroll	68.56%	66.76%
October 1:	• Expected employer contributions	82,979,021	82,219,626
	• Shortfall	194,544,533	185,523,490
Actuarial accrued liability for plan year beginning October 1:	• Retired members and beneficiaries	\$2,307,472,963	\$2,259,997,714
	• Inactive vested participants	204,418,060	194,543,442
	• Active participants	1,182,100,271	1,202,797,311
	• Inactive participants due a refund of employee contributions	9,047,179	9,571,672
	• Total	3,703,038,473	3,666,910,139
	• Normal cost including administrative expenses	53,750,366	55,466,779
Funded status for plan year beginning October 1:	• Market value of assets (MVA)	\$768,820,663	\$845,470,493
	• Unfunded actuarial accrued liability	2,934,217,810	2,821,439,646
October 1:	• Funded percentage	20.76%	23.06%
	• Projected insolvency in plan year beginning October 1	2023	2023
Key assumptions:	• Net investment return (long-term basis)	7.00%	7.00%
	• Inflation rate	2.50%	2.50%
GASB information	• Discount rate	4.25%	3.74%
	• Total pension liability	4,941,600,552	5,225,911,082
	• Plan fiduciary net position	768,820,663	845,470,493
	• Net pension liability	4,172,779,889	4,380,440,589
	• Plan fiduciary net position as a percentage of total pension liability	15.56%	16.18%
Demographic data for plan year beginning October 1	• Number of retired members and beneficiaries	8,702	8,592
	• Number of active members	9,368	9,448
	• Total payroll	\$404,775,714	\$401,071,344
	• Average payroll	43,208	42,450

¹ The ADEC is the actuarially determined contributions as developed in *Section 2*, net of projected member contributions.

Important Information About Actuarial Valuations

An actuarial valuation is a budgeting tool with respect to the financing of future projected obligations of a pension plan. It is an estimated forecast – the actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.

In order to prepare a valuation, Segal Consulting (“Segal”) relies on a number of input items. These include:

Plan of benefits	Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our report to confirm that Segal has correctly interpreted the plan of benefits.
Participant data	An actuarial valuation for a plan is based on data provided to the actuary by the System. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Assets	The valuation is based on the market value of assets as of the valuation date, as provided by the Fund Auditor.
Actuarial assumptions	In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan’s assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results, that does not mean that the previous assumptions were unreasonable.

The user of Segal's actuarial valuation (or other actuarial calculations) should keep the following in mind:

- The actuarial valuation is prepared at the request of the Board of Trustees of the Government Employees' Retirement System of the Virgin Islands (GERS). Segal is not responsible for the use or misuse of its report, particularly by any other party.
- An actuarial valuation is a measurement of the plan's assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. The actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.
- Actuarial results in this report are not rounded, but that does not imply precision.
- If GERS System is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.
- Segal does not provide investment, legal, accounting, or tax advice. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. The Board of Trustees should look to their other advisors for expertise in these areas.

As Segal Consulting has no discretionary authority with respect to the management or assets of the Plan, it is not a fiduciary in its capacity as actuaries and consultants with respect to the Plan.

Section 2: Actuarial Valuation Results

Member Data

The Actuarial Valuation and Review considers the number and demographic characteristics of covered members, including active members, inactive vested members, retired members and beneficiaries.

This section presents a summary of significant statistical data on these member groups.

The decline in the ratio of actives to retirees over the last 20 years indicates a smaller contribution base supporting the payment of benefits and expenses. There are inactive members with rights to deferred vested pensions and refund of employee contributions that are not shown in the chart below. For purposes of our valuation, the potential liabilities for such inactive members were estimated and reflected in the valuation.

More detailed information for this valuation year and the preceding valuation can be found in *Section 3, Exhibits A and B*.

MEMBER POPULATION: 2001 – 2018

Year Ended September 30	Active Members	Retired Members and Beneficiaries	Ratio of Actives to Retirees
2001	9,303	5,581	1.7
2003	10,037	6,093	1.6
2006	10,739	7,282	1.5
2011	10,376	7,592	1.4
2013	9,393	8,024	1.2
2014	9,227	8,465	1.1
2015	9,303	8,465	1.1
2016	9,499	8,520	1.1
2017	9,448	8,592	1.1
2018	9,368	8,702	1.1

¹ Excludes terminated members due a refund of employee contributions

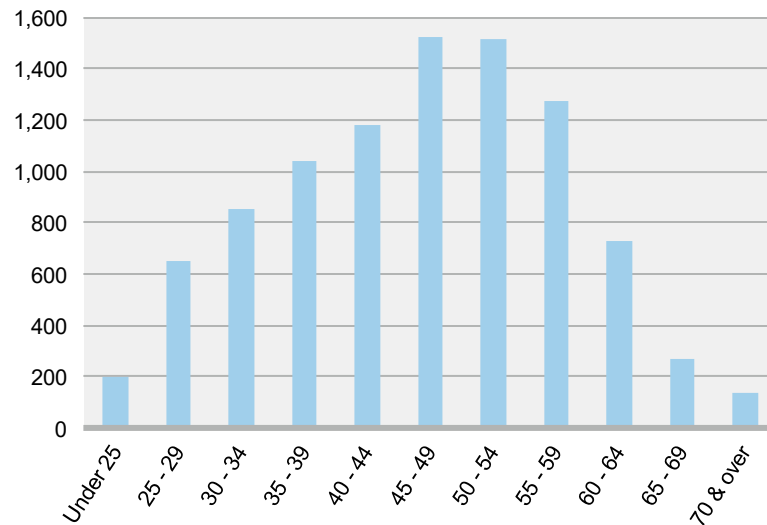
Active Members

Plan costs are affected by the age, years of credited service and payroll of active members. In this year's valuation, there were 9,368 active members including 4,660 Tier 2 employees with an average age of 46.8, average years of credited service of 14.5 years and average payroll of \$43,208. The 9,448 active members including 4,338 Tier 2 employees in the prior valuation had an average age of 46.6, average years of credited service of 14.6 years and average payroll of \$42,450.

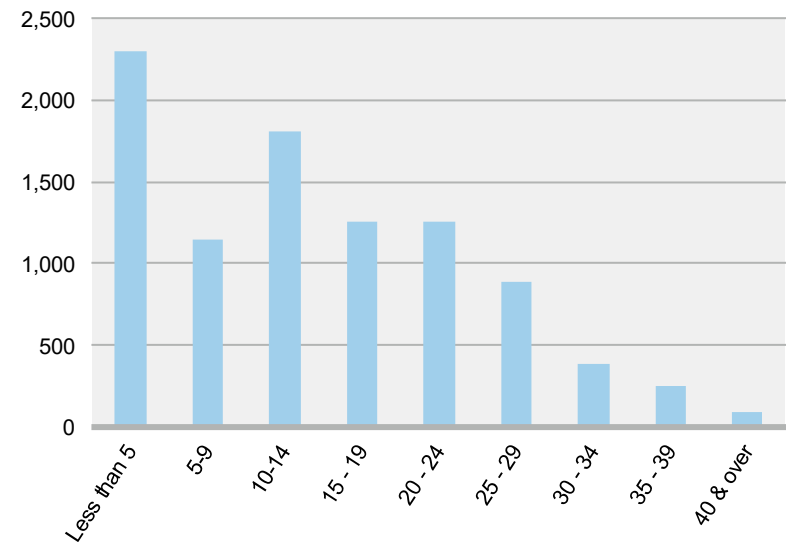
Tier 2 employees are those employees hired on or after October 1, 2005.

Distribution of Active Participants as of September 30, 2018

ACTIVES BY AGE



ACTIVES BY YEARS OF CREDITED SERVICE



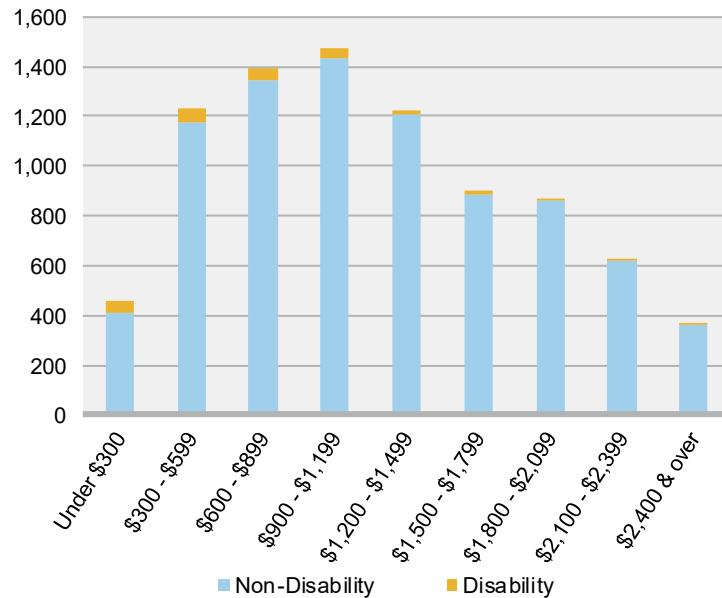
Retired Members and Beneficiaries

As of September 30, 2018, 8,547 retired members and 155 beneficiaries were receiving total semi-monthly benefits of \$10,526,119. For comparison, in the previous valuation, there were 8,427 retired members and 165 beneficiaries receiving monthly benefits of \$10,284,994.

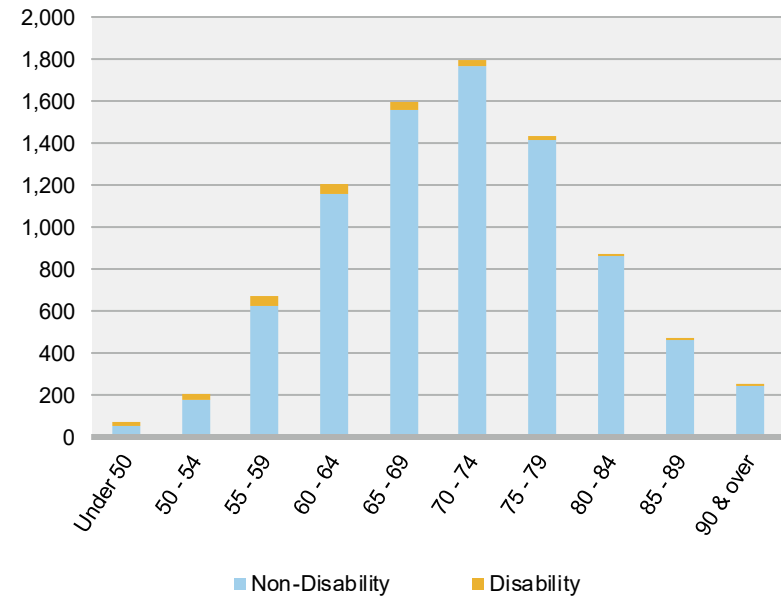
As of September 30, 2018, the average semi-monthly benefit for retired members is \$1,223, compared to \$1,212 in the previous valuation. The average age for retired members is 71.1 in the current valuation, compared with 70.9 in the prior valuation.

Distribution of Pensioners as of September 30, 2018

PENSIONERS BY TYPE AND MONTHLY AMOUNT



PENSIONERS BY TYPE AND AGE



Historical Plan Population

The chart below demonstrates the progression of the active population and the aging among the retired population over the last 20 years.

MEMBER DATA STATISTICS: 1999 – 2018

Year Ended September 30	Active Participants			Retired Members and Beneficiaries		
	Count	Average Age	Average Service	Count	Average Age	Average Semi-Monthly Amount
1999	10,763	44.2	13.5	6,212	68.3	\$595
2001	9,303	44.4	13.3	5,581	66.2	826
2003	10,037	45.2	14.5	6,093	67.3	863
2006	10,739	45.1	14.0	7,282	68.6	928
2011	10,376	45.7	13.9	7,592	69.4	1,104
2013	9,393	46.3	14.6	8,024	69.5	1,157
2014	9,227	46.2	14.4	8,465	69.7	1,168
2015	9,303	46.5	14.7	8,465	70.1	1,182
2016	9,499	46.3	14.5	8,520	70.5	1,192
2017	9,448	46.6	14.6	8,592	71.1	1,197
2018	9,368	46.8	14.5	8,702	71.2	1,210

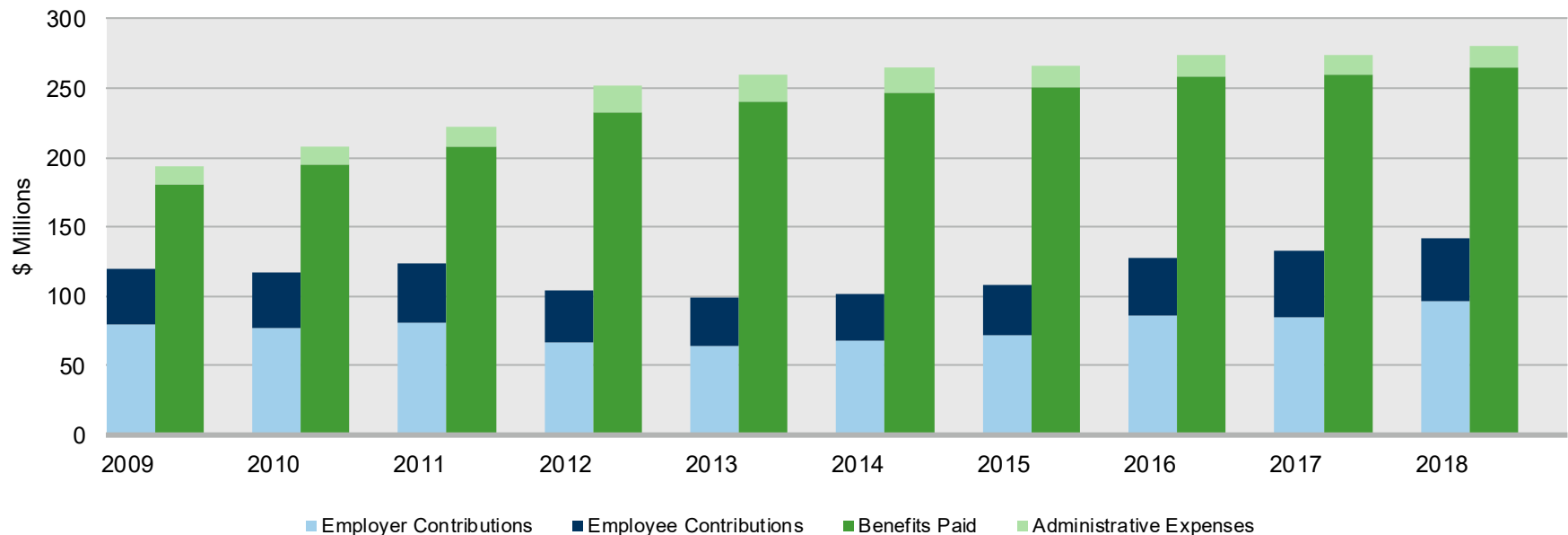
Financial Information

Retirement plan funding anticipates that, over the long term, both contributions and investment earnings (less investment fees) will be needed to cover benefit payments and administrative expenses. Retirement plan assets change as a result of the net impact of these income and expense components.

For each of the ten plan years, benefit payments and expenses have been significantly higher than contribution income.

Additional financial information, including a summary of transactions for the valuation year, is presented in *Section 3, Exhibits C and D*.

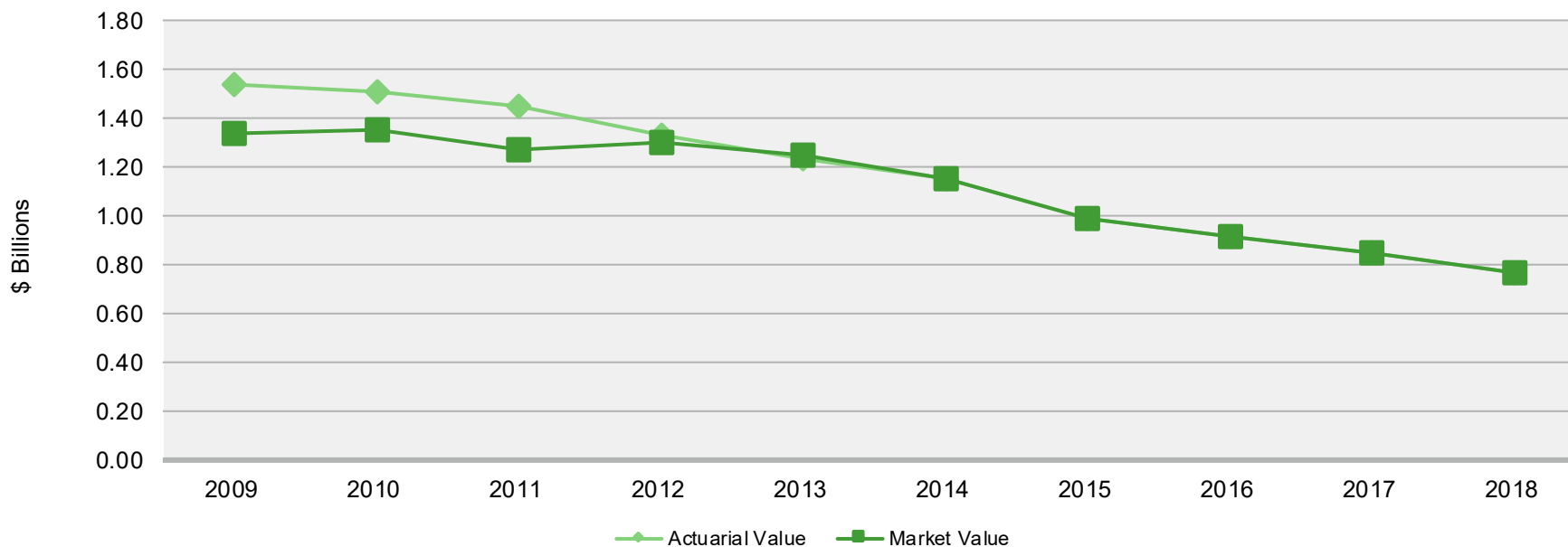
COMPARISON OF CONTRIBUTIONS MADE WITH BENEFITS AND EXPENSES PAID FOR YEARS ENDED SEPTEMBER 30, 2009 – 2018



The actuarial value is a representation of the System’s financial status. The actuarial asset value is significant because the Plan’s liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the contribution requirement.

Effective October 1, 2015, the actuarial value is the same as the market value of assets. Once the short-term cash flow issues have been addressed, it is recommended that the Board review different asset valuation methods and consider using a method that provides more level and stable long-term costs.

**ACTUARIAL VALUE OF ASSETS (VERSUS TO MARKET VALUE OF ASSETS)
AS OF SEPTEMBER 30, 2009 – 2018**



Actuarial Experience

To calculate any actuarially determined contribution, assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year actual experience is measured against the assumptions. If overall experience is more favorable than anticipated (an actuarial gain), any contribution requirement will decrease from the previous year. On the other hand, any contribution requirement will increase if overall actuarial experience is less favorable than expected (an actuarial loss).

Taking account of experience gains or losses in one year without making a change in assumptions reflects the belief that the single year's experience was a short-term development and that, over the long term, experience will return to the original assumptions. For contribution requirements to remain stable, assumptions should approximate experience.

If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

As shown below, the total loss is \$1,633,401. The net experience variation from individual sources other than investments was 0.05% of the actuarial accrued liability and was not significant. A discussion of the major components of the actuarial experience is on the following pages.

ACTUARIAL EXPERIENCE FOR YEAR ENDED SEPTEMBER 30, 2018

1	Net loss from investments ¹	-\$530,289
2	Net gain from administrative expenses	819,384
3	Net loss from other experience	-1,922,496
4	Net experience loss: 1 + 2 + 3	-\$1,633,401
¹ Details on next page.		

Investment Experience

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on the Plan's investment policy. The rate of return on the market value of assets was 6.93% for the year ended September 30, 2018.

For valuation purposes, the assumed rate of return is 7.00%. Since the actual return for the year was less than the assumed return, the System experienced an actuarial loss during the year ended September 30, 2018 with regard to its investments.

INVESTMENT EXPERIENCE

	Year Ended September 30,	
	2018	2017
1 Net investment income	\$54,077,199	\$67,401,361
2 Average value of assets	780,106,979	847,615,587
3 Rate of return: $1 \div 2$	6.93%	7.95%
4 Assumed rate of return	7.00%	7.00%
5 Expected investment income: 2×4	54,607,488	59,333,091
6 Actuarial gain (loss): $1 - 5$	<u>-\$530,289</u>	<u>\$8,068,270</u>

Because actuarial planning is long term, it is useful to see how the assumed investment rate of return has followed actual experience over time. The chart below shows the rate of return on a market value basis for the last 20 years, including averages over select time periods.

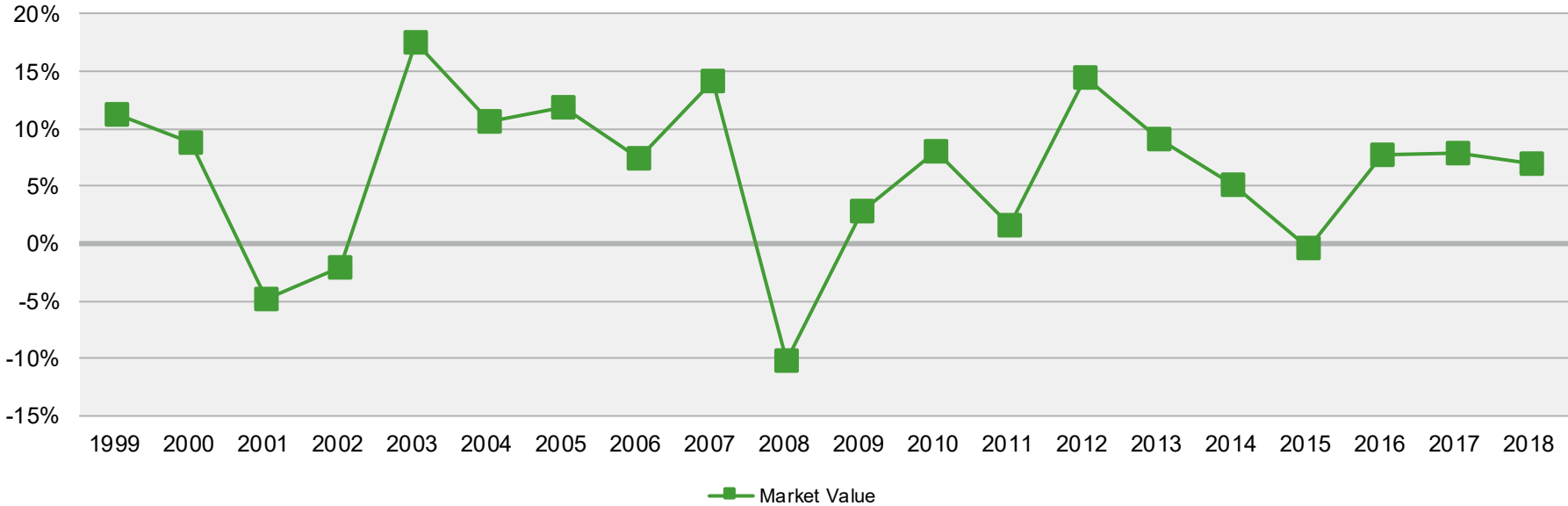
MARKET INVESTMENT RETURN 1999 – 2018

Market Value Investment Return			Market Value Investment Return		
Year Ended September 30	Amount	Percent	Year Ended September 30	Amount	Percent
1999	\$128,326,226	11.29%	2009	\$38,166,899	2.85%
2000	108,323,654	8.75	2010	104,159,043	8.05
2001	-63,417,148	-4.86	2011	19,891,578	1.53
2002	-24,338,277	-2.05	2012	174,056,576	14.48
2003	194,663,983	17.55	2013	111,523,919	9.12
2004	132,269,237	10.61	2014	60,326,921	5.14
2005	155,416,276	11.82	2015	-4,932,397	-0.46
2006	104,567,156	7.45	2016	70,993,934	7.73
2007	203,822,428	14.15	2017	67,401,361	7.95
2008	-160,719,061	-10.23	2018	54,077,199	6.93
1999 – 2018 average annual return					6.12%
1998 – 2007 average annual return					7.88%
2009 – 2018 average annual return					6.24%

Note: Each year's yield is weighted by the average asset value in that year.

The chart below illustrates the market rates of return over the past 20 years:

MARKET RATES OF RETURN FOR YEARS ENDED SEPTEMBER 30, 1999 – 2018



Administrative Expenses

Administrative expenses for the year ended September 30, 2018 totaled \$14,505,786 compared to the assumption of \$15,300,000. This resulted in a gain of \$819,384 for the year. Based on recent experience and future expectations, we have changed the assumption from \$15,300,000 to \$14,000,000, payable monthly, for the current year.

Other Experience

There are other differences between the expected and the actual experience that appear when the new valuation is compared with the projections from the previous valuation. These include:

- the extent of turnover among participants,
- retirement experience (earlier or later than projected),
- mortality (more or fewer deaths than projected),
- the number of disability retirements (more or fewer than projected), and
- salary increases (greater or smaller than projected).

Another difference may be a significant change in the participant data or changes resulting from estimating the potential liability for current inactive vested members that may be eligible for future benefits.

The net loss from this other experience for the year ended September 30, 2018 amounted to \$1,922,496, which is 0.05% of the actuarial accrued liability.

Changes in the Actuarial Accrued Liability

The actuarial accrued liability as of October 1, 2018 is \$3,703,038,473, an increase of \$36,128,334, or 1.0%, from the actuarial accrued liability as of the prior valuation date. The liability is expected to grow each year with normal cost and interest, and to decline due to benefit payments made. Additional fluctuations can occur due to actual experience that differs from expected (as discussed in the previous subsection).

Actuarial Assumptions

- As noted on the prior page, the administrative expenses assumption was decreased to \$14,000,000 for the year beginning October 1, 2018. There were no additional changes in the assumptions since the prior year.
- Details on actuarial assumptions and methods are in *Section 4, Exhibit I*.

Plan Provisions

- There were no changes in plan provisions since the prior valuation.
- A summary of plan provisions is in *Section 4, Exhibit II*.

Actuarially Determined Contribution

The actuarially determined contribution is equal to the normal cost payment and a payment on the unfunded actuarial accrued liability. As of October 1, 2018, the actuarially determined contribution is \$324,207,699, or 80.10% of projected payroll. Net of the projected member contributions of \$46,684,136, the actuarially determined employer contributions (ADEC) is \$277,523,563, or 68.56% of projected payroll.

The Board sets the funding policy used to calculate the ADEC based on a fixed amortization period of 20 years.

The ADEC as of October 1, 2018 is based on the data previously described, the actuarial assumptions and Plan provisions described in *Section 4*, including all changes affecting future costs adopted at the time of the actuarial valuation, actuarial gains and losses, and changes in the actuarial assumptions.

ACTUARIALLY DETERMINED CONTRIBUTION FOR YEAR BEGINNING OCTOBER 1

	2018		2017	
	Amount	% of Projected Payroll	Amount	% of Projected Payroll
1. Normal cost	\$40,251,600	9.94%	\$40,714,556	10.15%
2. Administrative expenses (beginning of year)	<u>13,498,766</u>	<u>3.33%</u>	<u>14,752,223</u>	<u>3.68%</u>
3. Employer normal cost: (1) + (2)	53,750,366	13.28%	55,466,779	13.83%
4. Actuarial accrued liability	3,703,038,473		3,666,910,139	
5. Actuarial value of assets	768,820,663		845,470,493	
6. Unfunded actuarial accrued liability: (4) - (5)	2,934,217,810		2,821,439,646	
7. Payment on unfunded actuarial accrued liability	258,849,910	63.95%	248,900,881	62.06%
8. Adjustment for timing ¹	<u>11,607,423</u>	<u>2.87%</u>	<u>11,301,731</u>	<u>2.82%</u>
9. Actuarially determined: (3) + (7) + (8)	<u>324,207,699</u>	<u>80.10%</u>	<u>\$315,669,391</u>	<u>78.71%</u>
10. Projected employer contributions	82,979,021	20.50%	82,219,626	20.50%
11. Projected member contributions	46,684,136	11.53%	47,926,275	11.95%
12. Total expected contributions: (10) + (11)	129,663,157	32.03%	130,145,901	32.45%
13. Shortfall: (9) – (12)	194,544,533	48.06%	185,523,490	46.26%
14. Projected payroll	\$404,775,714		\$401,071,344	

¹ Actuarially determined contributions are assumed to be paid on a monthly basis.

Reconciliation of Actuarially Determined Contribution

The chart below details the changes in the actuarially determined contribution from the prior valuation to the current year's valuation.

RECONCILIATION OF ACTUARIALLY DETERMINED CONTRIBUTION FROM OCTOBER 1, 2017 TO OCTOBER 1, 2018

	Amount	% of Payroll
Actuarially Determined Contribution as of October 1, 2017	\$315,669,391	78.71%
• Effect of open amortization period	-6,712,293	-1.67%
• Effect of change in administrative expense assumption	-1,300,000	-0.32%
• Effect of contributions less than actuarially determined contribution	16,877,566	4.21%
• Effect of investment loss	49,731	0.01%
• Effect of other gains and losses on accrued liability	103,451	0.03%
• Net effect of other changes, including composition and number of participants	-480,147	-0.12%
Total change	\$8,538,308	2.13%
Total change in percentage due to compensation change		-0.74%
Actuarially Determined Contribution as of October 1, 2018	\$324,207,699	80.10%

History of Employer Contributions

A history of the most recent years of contributions is shown below.

HISTORY OF EMPLOYER CONTRIBUTIONS: 2010 – 2019

	Actuarially Determined Employer Contribution (ADEC) ¹	Actual Employer Contribution	
Fiscal Year Ended September 30	Amount	Amount	Percent Contributed
2010 ²	\$157,817,709	\$77,004,630	48.79%
2011 ²	162,841,336	80,849,762	49.65%
2012	178,644,349	66,677,155	37.32%
2013 ²	172,439,842	64,431,322	37.36%
2014	189,715,251	68,298,617	36.00%
2015	200,089,791	72,287,934	36.13%
2016	247,158,137	86,346,838	34.94%
2017	250,574,023	84,802,335	33.84%
2018	267,743,116	96,747,868	36.13%
2019	277,523,563	Not yet available	Not yet available

¹ The ADEC is the actuarially determined contributions, net of projected member contributions.

² Estimated based on prior year's actuarial valuation.

Section 3: Supplemental Information

EXHIBIT A – TABLE OF PLAN COVERAGE

Category	Year Ended September 30		Change From Prior Year
	2018	2017	
Active members in valuation:			
• Number	9,368	9,448	-0.8%
• Average age	46.8	46.6	0.2
• Average years of credited service	14.5	14.6	-0.1
• Total payroll	\$404,775,714	\$401,071,344	0.9%
• Average payroll	\$43,208	\$42,450	1.8%
• Total active vested members	5,933	6,026	-1.5%
Retired members:			
• Number in pay status	8,547	8,427	1.4%
• Average age	71.1	70.9	0.2
• Average semi-monthly benefit	\$1,223	\$1,212	0.9%
Beneficiaries:			
• Number in pay status	155	165	-6.1%
• Average age	78.7	80.8	-2.1
• Average semi-monthly benefit	\$470	\$456	3.1%

**EXHIBIT B – MEMBERS IN ACTIVE SERVICE AS OF SEPTEMBER 30, 2018
BY AGE, YEARS OF CREDITED SERVICE, AND AVERAGE COVERED PAYROLL**

Age	Years of Credited Service									
	Total	Less than 5	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 & over
Under 25	199	193	6	--	--	--	--	--	--	--
	\$32,380	\$32,545	\$27,086	--	--	--	--	--	--	--
25 - 29	650	493	147	10	--	--	--	--	--	--
	35,733	35,973	34,676	\$39,464	--	--	--	--	--	--
30 - 34	852	388	253	204	7	--	--	--	--	--
	38,324	37,057	39,325	39,468	\$39,016	--	--	--	--	--
35 - 39	1,042	309	183	391	149	10	--	--	--	--
	40,944	39,016	40,243	41,755	43,311	\$46,363	--	--	--	--
40 - 44	1,179	219	136	311	331	169	13	--	--	--
	43,485	39,923	39,475	42,597	45,530	48,175	\$53,632	--	--	--
45 - 49	1,521	233	129	291	272	418	168	10	--	--
	45,172	40,644	39,738	41,272	45,310	49,570	51,044	\$47,996	--	--
50 - 54	1,520	176	93	210	212	320	362	129	18	--
	46,528	40,603	40,991	39,921	44,264	48,572	52,021	52,593	\$46,539	--
55 - 59	1,276	149	94	202	155	178	204	155	131	8
	45,121	40,512	40,934	37,686	42,803	46,020	49,331	52,730	50,799	\$45,044
60 - 64	727	96	65	100	89	108	100	63	71	35
	44,895	41,163	42,548	38,584	39,290	45,099	46,265	53,173	55,188	51,438
65 - 69	269	27	29	62	28	32	25	24	19	23
	47,839	49,230	46,479	38,057	43,029	49,298	44,034	61,375	62,529	55,987
70 & over	133	15	5	25	17	25	10	9	7	20
	45,194	41,055	40,306	35,672	40,954	45,207	46,739	44,437	44,015	64,993
Total	9,368	2,298	1,140	1,806	1,260	1,260	882	390	246	86
	\$43,208	\$38,182	\$39,512	\$40,496	\$44,077	\$48,126	\$50,298	\$52,976	\$52,467	\$55,212

EXHIBIT C – SUMMARY STATEMENT OF INCOME AND EXPENSES ON A MARKET VALUE BASIS

	Year Ended September 30, 2018	Year Ended September 30, 2017
Net assets at market value at the beginning of the year	\$845,470,493	\$917,162,043
Contribution income:		
• Employer contributions	\$96,747,868	\$84,802,335
• Employee contributions	<u>44,481,827</u>	<u>47,925,193</u>
<i>Total contribution income</i>	\$141,229,695	\$132,727,528
Other income	\$7,880,224	\$2,641,472
Investment income:		
• Interest, dividends and other income	\$18,297,337	\$14,137,472
• Asset appreciation	37,034,990	55,810,550
• Less investment fees	<u>-1,255,128</u>	<u>-2,546,660</u>
<i>Net investment income</i>	<u>\$54,077,199</u>	<u>\$67,401,361</u>
Total income available for benefits	\$203,187,118	\$202,770,361
Less benefit payments and administrative expenses:		
• Benefits paid to members	-\$253,918,529	-\$251,845,293
• Refunds of employee contributions	-11,412,633	-7,619,585
• Administrative expenses	<u>-14,505,786</u>	<u>-14,997,033</u>
<i>Total benefit payments and administrative expenses</i>	-\$279,836,948	-\$274,461,911
Change in reserve for future benefits	-\$76,649,830	-\$71,691,550
Net assets at market value at the end of the year	\$768,820,663	\$845,470,493

EXHIBIT D – DEVELOPMENT OF THE FUND THROUGH SEPTEMBER 30, 2018

Year Ended September 30	Employer Contributions	Employee Contributions	Other Income	Net Investment Return ¹	Admin. Expenses	Benefit Payments	Actuarial Value of Assets at Year-End ³
2009	\$80,177,004	\$40,099,762	\$0	\$75,674,851	\$13,364,747	\$180,533,545	\$1,534,935,280
2010	77,004,630	40,107,669	0	62,251,642	13,609,415	194,685,196	1,506,004,610
2011	80,849,762	42,997,146	0	40,829,900	14,440,676	207,314,151	1,448,926,591
2012	66,677,155	37,727,063	2,239,690 ²	23,046,297	18,481,417	233,096,472	1,327,038,907
2013	64,431,322	34,090,376	-783,854 ²	72,583,326	19,581,770	240,564,834	1,237,213,473
2014	68,298,617	34,020,107	3,573,611	77,187,305	18,494,773	247,069,503	1,154,728,837
2015	72,287,934	36,245,015	1,161,300	-6,869,860 ²	16,401,721	250,110,255	991,041,251
2016	86,346,838	41,459,511	1,599,307	70,993,934	15,267,630	259,011,168	917,162,043
2017	84,802,335	47,925,193	2,641,472	67,401,361	14,997,033	259,464,878	845,470,493
2018	96,747,868	44,481,827	7,880,224	54,077,199	14,505,786	265,331,162	768,820,663

¹ Net of investment fees

² Includes adjustment due to restatement from draft financial statements

³ Effective in 2015, the actuarial value of assets is equal to market value of assets

EXHIBIT E – DEFINITION OF PENSION TERMS

The following list defines certain technical terms for the convenience of the reader:

Actuarial Accrued Liability for Actives:	The equivalent of the accumulated normal costs allocated to the years before the valuation date.
Actuarial Accrued Liability for Pensioners and Beneficiaries:	The single-sum value of lifetime benefits to existing pensioners and beneficiaries. This sum takes account of life expectancies appropriate to the ages of the annuitants and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Actuarial Cost Method:	A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the actuarially determined contribution.
Actuarial Gain or Loss:	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. Through the actuarial assumptions, rates of decrements, rates of salary increases, and rates of fund earnings have been forecasted. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge which may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield in actuarial liabilities that are larger than projected. Actuarial gains will shorten the time required for funding of the actuarial balance sheet deficiency while actuarial losses will lengthen the funding period.
Actuarially Equivalent:	Of equal actuarial present value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV):	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is: Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.) Multiplied by the probability of the occurrence of an event (such as survival, death, disability, withdrawal, etc.) on which the payment is conditioned, and Discounted according to an assumed rate (or rates) of return to reflect the time value of money.

Actuarial Present Value of Future Plan Benefits:	The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Plan Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.
Actuarial Valuation:	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan. An Actuarial Valuation for a governmental retirement system typically also includes calculations of items needed for compliance with GASB, such as the Actuarially Determined Contribution (ADC) and the Net Pension Liability (NPL).
Actuarial Value of Assets (AVA):	The value of the Fund's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the ADC.
Actuarially Determined:	Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the law.
Actuarially Determined Contribution (ADC):	The periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under the Plan's funding policy. The ADC consists of the Normal Cost and the Amortization Payment.
Amortization Method:	A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.
Amortization Payment:	The portion of the pension plan contribution, or ADC, that is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.

Assumptions or Actuarial Assumptions:	The estimates upon which the cost of the Fund is calculated, including: <u>Investment return</u> - the rate of investment yield that the Fund will earn over the long-term future; <u>Mortality rates</u> - the death rates of employees and pensioners; life expectancy is based on these rates; <u>Retirement rates</u> - the rate or probability of retirement at a given age or service; <u>Disability rates</u> – the probability of disability retirement at a given age; <u>Withdrawal rates</u> - the rates at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement; <u>Salary increase rates</u> - the rates of salary increase due to inflation and productivity growth.
Closed Amortization Period:	A specific number of years that is counted down by one each year, and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc. See Open Amortization Period.
Decrements:	Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or withdrawal.
Defined Benefit Plan:	A retirement plan in which benefits are defined by a formula applied to the member's compensation and/or years of service.
Defined Contribution Plan:	A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.
Employer Normal Cost:	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Experience Study:	A periodic review and analysis of the actual experience of the Fund that may lead to a revision of one or more actuarial assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified as deemed appropriate by the Actuary.
Funded Ratio:	The ratio of the actuarial value of assets (AVA) to the actuarial accrued liability (AAL). Plans sometimes calculate a market funded ratio, using the market value of assets (MVA), rather than the AVA.

GASB 67 and GASB 68:	Governmental Accounting Standards Board (GASB) Statements No. 67 and No. 68. These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 68 sets the accounting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves.
Investment Return:	The rate of earnings of the Fund from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.
Net Pension Liability (NPL):	The Net Pension Liability is equal to the Total Pension Liability minus the Plan Fiduciary Net Position.
Normal Cost:	That portion of the Actuarial Present Value of pension plan benefits and expenses allocated to a valuation year by the Actuarial Cost Method. Any payment in respect of an Unfunded Actuarial Accrued Liability is not part of Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of employee contributions and employer Normal Cost unless otherwise specifically stated.
Open Amortization Period:	An open amortization period is one which is used to determine the Amortization Payment but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in determining the Amortization Period each year. In theory, if an Open Amortization Period with level percentage of payroll is used to amortize the Unfunded Actuarial Accrued Liability, the UAAL will never decrease, but will become smaller each year, in relation to covered payroll, if the actuarial assumptions are realized.
Plan Fiduciary Net Position:	Market value of assets.
Total Pension Liability (TPL):	The actuarial accrued liability under the entry age normal cost method and based on the blended discount rate as described in GASB 67 and 68.
Unfunded Actuarial Accrued Liability:	The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus.
Valuation Date or Actuarial Valuation Date:	The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Plan Benefits is determined. The expected benefits to be paid in the future are discounted to this date.

Section 4: Actuarial Valuation Basis

EXHIBIT I – ACTUARIAL ASSUMPTIONS AND ACTUARIAL COST METHOD

Rationale for Assumptions and Methods:	<p>The assumptions and methods used in this valuation are based on the results of the Actuarial Experience Study as of September 30, 2015 and were approved by the Board of Trustees. Current data was reviewed in conjunction with this valuation. Based on professional judgment, no additional assumption or method changes are warranted at this time.</p>
Mortality Rates:	<p>Non-annuitant: 110% of the RP-2014 Blue Collar Employee Mortality Table with generational projection from 2015 using Scale MP-2015</p> <p>Healthy annuitant: 110% of the RP-2014 Blue Collar Healthy Annuitant Mortality Table with generational projection from 2015 using Scale MP-2015</p> <p>Disabled annuitant: 125% of the RP-2014 Disabled Annuitant Mortality Table with generational projection from 2015 using Scale MP-2015</p> <p>The underlying tables reasonably reflect the mortality experience of the System as of the measurement date. These mortality tables were then adjusted to future years using the generational projection to reflect future mortality improvement between the measurement date and those years.</p>

Termination Rates before Retirement:

Age	Rate (%)				
	Mortality ¹		Disability		Withdrawal ²
	Male	Female	Regular	Public Safety	Regular and Public Safety
20	0.06	0.02	0.03	0.05	3.97
25	0.07	0.02	0.03	0.05	3.86
30	0.06	0.03	0.03	0.05	3.61
35	0.07	0.04	0.03	0.06	3.14
40	0.09	0.05	0.05	0.09	2.58
45	0.14	0.08	0.09	0.18	1.99
50	0.24	0.14	0.20	0.40	1.88
55	0.40	0.21	0.43	0.85	0.47
60	0.67	0.30	0.87	1.74	0.05

¹ Mortality rates shown for base table.

² Withdrawal rates do not apply at or beyond early retirement age.

No withdrawal and disability rates assumed for judges and legislature members.

Retirement Rates for Actives:

Age	Retirement Rates for Regular Members (%)		Age	Retirement Rates for Regular Members (%)	
	<30 Years of Service	>=30 Years of Service		<30 Years of Service	>=30 Years of Service
50-59	3	15	66	7	25
60-61	10	20	67-68	7	15
62-63	10	35	69-70	15	50
64	10	25	71 & older	100	100
65	20	25			

		Retirement Rates for Public Safety Members (%)			
		Age	Rate	Age	Rate
		<50 with at least 20 years of service	10	55 - 59	10
		50 - 51	5	60	40
		52	15	61 - 64	20
		53 - 54	5	65 & older	100
		Judges:	100% at earlier of age 50 with at least 20 years of service or age 70 with at least six years of service.		
		Legislature:	100% at earlier of any age with at least 20 years of service or age 60 with at least six years of service.		
Retirement Age for Inactive Vested Participants:	65				
Unknown Data for Participants:	Same as those exhibited by participants with similar known characteristics. If not specified, participants are assumed to be male.				
Adjustment to Inactive Vested Data	Service information for inactive vested participants was determined based on dates of hire and termination, if available. If not available, inactive vested participants were assumed to have ten years of service as of the valuation date. Vested benefit amounts were estimated based on participant's salary and assumed service.				
Percent Married:	80%				
Age of Spouse:	Females three years younger than males				
Net Investment Return:	7.00%. The net investment return assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment. As part of the analysis, a building block approach was used that reflects inflation expectations and anticipated risk premiums for each of the portfolio's asset classes, as well as the Plan's target asset allocation.				
Salary Increases:	3.25% per year				

Administrative Expenses:	\$14,000,000, payable monthly for the year beginning October 1, 2018.
Actuarial Value of Assets:	At market value
Actuarial Cost Method:	Entry Age Normal Actuarial Cost Method. Entry Age is the age at the time the participant commenced employment. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated as a level percent of salary with Normal Cost determined as if the current benefit accrual rate of the participant's job category and tier of benefits had always been in effect.
Changes in Assumptions:	Based on past experience and future expectations, the administrative expense assumption was revised from \$15,300,000 to \$14,000,000.

EXHIBIT II – SUMMARY OF PLAN PROVISIONS

This exhibit summarizes the major provisions of the Plan included in the valuation. It is not intended to be, nor should it be interpreted as, a complete statement of all plan provisions.

Plan Year:	October 1 through September 30
Plan Status:	Ongoing plan
Service Pension:	
Regular Employees	
Tier 1	
Eligibility	<ul style="list-style-type: none"> • Age 60 with 10 years of service or any age with 30 years of service
Amount	<ul style="list-style-type: none"> • 2.5% of Final Average Salary¹ per year of service up to 100%
Tier 2	
Eligibility	<ul style="list-style-type: none"> • Age 65 with 10 years of service
Amount	<ul style="list-style-type: none"> • 1.75% of Career Average Salary¹ per year of service up to 100%
Public Safety Employees	
Tier 1	
Eligibility	<ul style="list-style-type: none"> • Age 55 with 10 years of service or any age with 20 years of service
Amount	<ul style="list-style-type: none"> • 3.0% of Final Average Salary¹ per year of service up to 90%
Tier 2	
Eligibility	<ul style="list-style-type: none"> • Age 60 with 10 years of service or age 58 with 25 years of service
Amount	<ul style="list-style-type: none"> • 1.75% of Career Average Salary¹ per year of service under 20 years and 2.10% of Career Average Salary¹ per year of service for service greater than or equal to 20 years, up to 90%

¹ Final Average Salary for Regular and Public Safety Employees is based on the average of the highest annual salary up to a maximum of \$65,000 for any five years in the last 10 years. Career Average Salary is also limited to a maximum of \$65,000 for each year of service.

Legislature²	
Tier 1	
Eligibility	<ul style="list-style-type: none"> • Age 50 with 6 years of service or any age with 20 years of service
Amount	<ul style="list-style-type: none"> • 2.5% of highest compensation for years 1-6 • 3% of highest compensation for years 7-12 • 4% of highest compensation for years above 12, up to a maximum of 75%
Tier 2	
Eligibility	<ul style="list-style-type: none"> • Age 50 with 6 years of service or any age with 20 years of service
Amount	<ul style="list-style-type: none"> • 3.5% of highest compensation for years 1-6 • 4% of highest compensation for years 7-12 • 4.5% of highest compensation for years 13-20 • 5% of highest compensation for years above 20, up to a maximum of 100%
Judges	
Eligibility	<ul style="list-style-type: none"> • Age 50 with 6 years of service
Amount	<ul style="list-style-type: none"> • 5% of highest compensation per year of service up to 100%
Early Retirement:	
Regular Employees	
Tier 1	
Eligibility	<ul style="list-style-type: none"> • Age 50 with 10 years of service
Amount	<ul style="list-style-type: none"> • Service Pension reduced 3.9% per year less than age 60
Tier 2	
Eligibility	<ul style="list-style-type: none"> • Age 60 with 10 years of service
Amount	<ul style="list-style-type: none"> • Service Pension reduced 3.9% per year less than age 65

² Annual compensation for Legislature is limited to a maximum of \$85,000.

Public Safety Employees	
Tier 1	
Eligibility	<ul style="list-style-type: none"> • Age 50 with 10 years of service
Amount	<ul style="list-style-type: none"> • Service Pension reduced 3.9% per year less than age 55
Tier 2	
Eligibility	<ul style="list-style-type: none"> • Age 55 with 10 years of service
Amount	<ul style="list-style-type: none"> • Service Pension reduced 3.9% per year less than age 60
Disability:	
Duty Connected Disability	
Eligibility	<ul style="list-style-type: none"> • Total and permanent disability as a result of performance of duty
Amount	<ul style="list-style-type: none"> • Tier 1: 75% of salary (not to exceed \$65,000) less workers compensation • Tier 2: 52.5% of salary (not to exceed \$65,000) less workers compensation
Non-Duty Connected Disability	
Eligibility	<ul style="list-style-type: none"> • 9 years of service and total and permanent disability
Amount	<ul style="list-style-type: none"> • Tier 1: 2.0% of Final Average Salary¹ per year of service up to 60%, 20% minimum • Tier 2: 1.4% of Final Average Salary¹ per year of service up to 42%, 14% minimum

¹ Final Average Salary for Regular and Public Safety Employees is based on the average of the highest annual salary up to a maximum of \$65,000 for any five years in the last 10 years. Career Average Salary is also limited to a maximum of \$65,000 for each year of service.

Vesting:	
Eligibility	<ul style="list-style-type: none"> • 10 years of service and leave contributions in System
Amount	<ul style="list-style-type: none"> • Service pension accrued at termination
Severance Benefit:	
Amount	<ul style="list-style-type: none"> • Refund of contributions with 4% annual interest, if no other benefits payable.
Post-Retirement COLA:	
Disabled pensioners	<ul style="list-style-type: none"> • 1% of the original retirement benefit each year up to age 60, 1.5% thereafter.
Pensioners and Survivor annuitants	<ul style="list-style-type: none"> • None
Pre-Retirement Death Benefits:	
Duty Connected Death	
Eligibility	<ul style="list-style-type: none"> • Death in service as a result of performance of duty
Amount	<ul style="list-style-type: none"> • Tier 1: Annuity of 40% of salary in effect on date of death to widow plus 10% of salary for each child up to age 18 to a maximum family benefit of 60% of salary. If no widow, 10% of salary is payable on behalf of each child under age 18 to a maximum family benefit of 50%. If no widow or children, each dependent parent is entitled to 25% of salary. • Tier 2: Annuity of 28% of salary in effect on date of death to widow plus 7% of salary for each child up to age 18 to a maximum family benefit of 42% of salary. If no widow, 7% of salary is payable on behalf of each child under age 18 to a maximum family benefit of 35%. If no widow or children, each dependent parent is entitled to 17.5% of salary.
Non-Duty Connected Death	
Eligibility	<ul style="list-style-type: none"> • Death in service
Amount	<ul style="list-style-type: none"> • Accumulated contributions of deceased member to designated beneficiary. • Tier 1: If, at the time of death, the member was eligible for a service or early retirement annuity, the surviving spouse, if any, can elect a 100% survivor annuity based on the benefit which would have been payable to the member had he/she retired the date before he/she died.

Post-Retirement Death Benefits:	
Lump-sum Benefit	<ul style="list-style-type: none"> • Lump sum payment equal to the excess of the sum of contributions plus annual salary at retirement (maximum \$10,000) over the total of benefits paid.
Husband and Wife	<ul style="list-style-type: none"> • If married, pension benefits are paid in the form of a joint and survivor annuity unless this form is rejected by the participant and spouse. If not rejected, the benefit amount otherwise payable is reduced to reflect the joint and survivor coverage. If rejected, or if not married, benefits are payable for the life of the employee, or in any other available optional form elected by the employee in an actuarially equivalent amount.
Optional Forms of Payment:	<ul style="list-style-type: none"> • 50% joint-and-survivor annuity • 100% joint-and-survivor annuity

EXHIBIT III – CONTRIBUTION RATES

Employer Contribution Rate	20.5% of payroll, effective January 1, 2015
Employee Contribution Rates	Percent of payroll effective January 1, 2017
Tier 1	
Regular Employees	11%
Public Safety Employees	13%
Legislature	12%
Judges	15%
Tier 2	
Regular Employees	11.5%
Public Safety Employees	13.625%
Legislature	14%
Judges	15%

Section 5: GASB Information

EXHIBIT 1 – NET PENSION LIABILITY

The components of the net pension liability at September 30, 2018 were as follows:

Total pension liability	\$4,941,600,552
Plan fiduciary net position	768,820,663
Net pension liability	4,172,779,889
Plan fiduciary net position as a percentage of the total pension liability	15.56%

Actuarial assumptions. The total pension liability was determined by an actuarial valuation as of September 30, 2018, using the following actuarial assumptions, applied to all periods included in the measurement:

Inflation	2.50%
Salary increases	3.25%, including inflation
Investment rate of return	4.25%, net of pension plan investment expense, including inflation

The demographic assumptions are the same as the assumptions used in the October 1, 2018 funding valuation and are based on the results of an actuarial experience study for the period October 1, 2011 through September 30, 2015.

Mortality rates for healthy lives are based on 110% of the RP-2014 Blue Collar Healthy Annuitant and Employee Mortality Tables with generational projection from 2015 using Scale MP-2015. Mortality rates for disabled lives are based on 125% of the RP-2014 Disabled Retiree Mortality Table with generational projection from 2015 using Scale MP-2015.

The long-term expected rate of return on pension plan investments was determined using a building-block method in which best-estimate ranges of expected future real rates of return (expected returns, net of pension plan investment expense and inflation) are developed for each major asset class. These ranges are combined to produce the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and by adding expected inflation. Best estimates of arithmetic real rates of return for each major asset class included in the pension plan's target asset allocation as of September 30, 2018 are summarized in the following table:

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return ¹
Domestic equity	29%	6.16%
International equity	12%	6.71%
Fixed income	27%	1.71%
Cash	2%	0.91%
Alternatives (including Local Assets)	30%	5.50%
Total	100%	

¹ Real rates of return are net of inflation.

Discount rate: The discount rate used to measure the total pension liability was 4.25% as of September 30, 2018 and 3.74% as of September 30, 2017. The projection of cash flows used to determine the discount rate assumed plan member contributions will be made at the current contribution rate. Based on those assumptions, the pension plan's fiduciary net position was not projected to be available to make all projected future benefit payments of current plan members. Therefore, the long-term expected rate of return on pension plan investments of 7.0% was applied to all periods of projected benefit payments that are covered by projected assets. For periods where projected future benefit payments are not covered by projected assets, the yield on a 20-year AA Municipal Bond Index was applied. As of September 30, 2018, that rate was 4.18%.

Note, the discount rate to measure the total pension liability as of September 30, 2017 was developed using the same method as described above but a 20-Year AA Municipal Bond Index of 3.64% as of September 30, 2017 was applied to those periods where projected benefit payments were not covered by projected assets.

Sensitivity of the net pension liability to changes in the discount rate. The following presents the net pension liability, calculated using the discount rate of 4.25%, as well as what the net pension liability would be if it were calculated using a discount rate that is one-percentage-point lower (3.25%) or one-percentage-point higher (5.25%) than the current rate:

	1% Decrease (3.25%)	Current Discount (4.25%)	1% Increase (5.25%)
Net pension liability	\$4,799,838,763	\$4,172,779,889	\$3,651,772,906

EXHIBIT 2 – SCHEDULE OF CHANGES IN NET PENSION LIABILITY

	2018	2017	2016	2015	2014
Total pension liability					
• Service cost	\$89,233,179	\$101,716,941	\$87,734,650	\$69,262,969	\$65,274,936
• Interest	193,824,703	176,503,962	192,803,756	184,451,782	191,113,749
• Change of benefit terms	0	0	-48,588,579	0	-40,421,809
• Differences between expected and actual experience	2,839,939	25,049,512	76,689,946	98,193,233	35,917,905
• Changes of assumptions	-304,877,189	-361,658,766	431,433,618	731,994,972	241,527,329
• Benefit payments, including refunds of employee contributions	<u>-265,331,162</u>	<u>-259,464,878</u>	<u>-259,011,168</u>	<u>-250,110,255</u>	<u>-247,069,503</u>
Net change in total pension liability	<u>-\$284,310,530</u>	<u>-\$317,853,229</u>	<u>\$481,062,223</u>	<u>\$833,792,701</u>	<u>\$246,342,607</u>
Total pension liability – beginning	<u>5,225,911,082</u>	<u>5,543,764,311</u>	<u>5,062,702,088</u>	<u>4,228,909,387</u>	<u>3,982,566,780</u>
Total pension liability – ending (a)	<u>\$4,941,600,552</u>	<u>\$5,225,911,082</u>	<u>\$5,543,764,311</u>	<u>\$5,062,702,088</u>	<u>\$4,228,909,387</u>
Plan fiduciary net position					
• Contributions – employer	\$96,747,868	\$84,802,335	\$86,346,597	\$72,287,934	\$68,298,617
• Contributions – employee	44,481,827	47,925,193	41,459,511	36,245,015	34,020,107
• Net investment income	54,077,199	67,401,362	70,993,934	4,967,602	60,326,921
• Benefit payments, including refunds of employee contributions	-265,331,162	-259,464,878	-259,011,168	-250,110,255	-247,069,503
• Administrative expense	-14,505,786	-14,997,033	-15,267,630	-16,401,722	-18,867,491
• Other	<u>7,880,224</u>	<u>2,641,471</u>	<u>1,599,548</u>	<u>1,161,301</u>	<u>3,573,611</u>
Net change in plan fiduciary net position	<u>-\$76,649,830</u>	<u>-\$71,691,550</u>	<u>-\$73,879,208</u>	<u>-\$151,850,124</u>	<u>-\$99,717,738</u>
Plan fiduciary net position – beginning	<u>845,470,493</u>	<u>917,162,043</u>	<u>991,041,251</u>	<u>1,142,891,375</u>	<u>1,242,609,113</u>
Plan fiduciary net position – ending (b)	<u>\$768,820,663</u>	<u>\$845,470,493</u>	<u>\$917,162,043</u>	<u>\$991,041,251</u>	<u>\$1,142,891,375</u>
Net pension liability – ending (a) – (b)	<u>\$4,172,779,889</u>	<u>\$4,380,440,589</u>	<u>\$4,626,602,268</u>	<u>\$4,071,660,837</u>	<u>\$3,086,018,012</u>
Plan fiduciary net position as a percentage of the total pension liability	15.56%	16.18%	16.54%	19.58%	27.03%
Covered employee payroll¹	\$404,775,714	\$393,771,228	\$368,023,518	\$355,603,653	\$370,131,865
Net pension liability as percentage of covered employee payroll	1,030.89%	1,112.43%	1,257.15%	1,145.00%	833.76%

¹ Covered employee payroll as reported in the participant data as of each valuation date

Notes to Schedule:

Benefits provided.

In the year ended September 30, 2016, there were changes to the eligibility and benefit amounts for Tier 2 Regular and Public Safety Employees for Service and Early pensions reflected in this valuation. The plan of benefits, including those changes, are described in detail in Section 4 of the report.

Change of Assumptions:

In the year ended September 30, 2014, amounts reported as changes in assumptions resulted from a decrease in the discount rate used to measure the total pension liability from 4.87% as of September 30, 2013 to 4.42% as of September 30, 2014.

In the year ended September 30, 2015, amounts reported as changes in assumptions resulted from a decrease in the discount rate used to measure the total pension liability from 4.42% as of September 30, 2014 to 3.84% as of September 30, 2015 and several changes in assumptions based on the actuarial experience study as of September 30, 2015 adopted by the Board effective September 30, 2015. The changes include changes to the long-term expected rate of return, salary scale, inflation, the mortality assumption for healthy and disabled lives including the provision for future mortality improvement, retirement ages for active members and pre-retirement decrement rates for turnover and disability.

In the year ended September 30, 2016, amounts reported as changes in assumptions resulted from a decrease in the discount rate used to measure the total pension liability from 3.84% as of September 30, 2015 to 3.20% as of September 30, 2016.

In the year ended September 30, 2017, amounts reported as changes in assumptions resulted from an increase in the discount rate and to measure the total pension liability from 3.20% as of September 30, 2016 to 3.74% as of September 30, 2017.

In the year ended September 30, 2018, amounts reported as changes in assumptions resulted from an increase in the discount rate and to measure the total pension liability from 3.74% as of September 30, 2017 to 4.25% as of September 30, 2018.

EXHIBIT 3 – SCHEDULE OF EMPLOYER CONTRIBUTIONS

Year Ended September 30	Actuarially Determined Employer Contributions	Contributions in Relation to the Actuarially Determined Employer Contributions	Contribution Deficiency (Excess)	Covered-Employee Payroll	Contributions as a Percentage of Covered Employee Payroll
2009 ¹	\$147,490,851	\$80,177,004	\$67,313,847	\$433,549,406	18.49%
2010 ¹	157,817,709	77,004,630	80,813,079	458,154,309	16.81%
2011 ¹	162,841,336	80,849,762	81,991,574	440,026,457	18.37%
2012	178,644,349	66,677,155	111,967,194	403,473,988	16.53%
2013 ¹	172,439,842	64,431,322	108,008,520	381,012,309	16.91%
2014	189,715,251	68,298,617	121,416,634	370,131,865	18.45%
2015	200,089,791	72,287,934	127,801,857	355,603,653	20.33%
2016	247,158,137	86,346,838	160,811,299	368,023,518	23.46%
2017	250,574,023	84,802,335	165,771,688	393,771,228	21.54%
2018	267,743,116	96,747,868	170,995,248	401,071,344	24.12%

¹ Estimated based on prior year's actuarial valuation.

Notes to Schedule:

Methods and assumptions used:

Valuation date	Actuarially determined contribution are calculated as of October 1
Actuarial cost method	Entry age Normal Cost Method determined as a level percent of salary
Amortization method	Level dollar
Amortization period	20 years open amortization
Asset valuation method	Market value

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